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Body Measurements of Male Students Entering the University of Kansas

By

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KANSAS STUDIES IN EDUCATION
UNIVERSITY OF KANSAS PUBLICATIONS
SCHOOL OF EDUCATION - LAWRENCE, KANSAS

Vol. 4 MAY, 1954 No. 2

FOREWORD

Sincere appreciation is expressed to Dr. Ralph Canuteson, Director of the University of Kansas Health Service for allowing the use of student records and for other valuable cooperation in the collection of the data for this study. The work of Robert S. Bell in assisting in gathering the data was fully appreciated. Acknowledgement is also made to Dean Kenneth E. Anderson for assistance and advice in the preparation of this report and to Dr. Oscar M. Haugh for his editorial work.

Edwin R. Elbel

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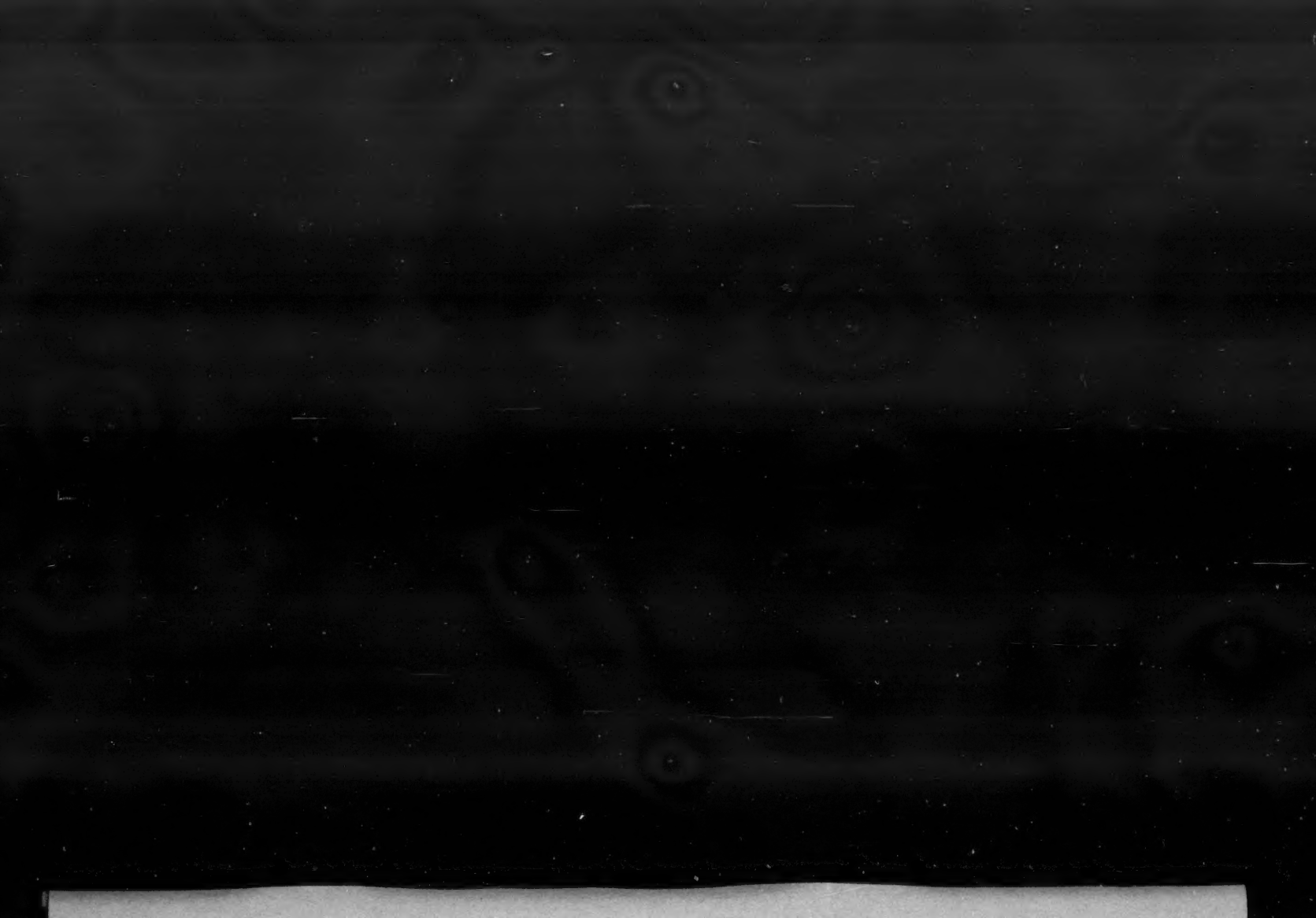

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INTRODUCTION

Recent studies show a definite increase in the average height and weight of present-day college and university students when compared with the measurements of students of comparable age of an earlier day.

Chenoweth (1)* secured height, weight, and age of each of 8964 men and 4124 women entering the University of Cincinnati between the years 1916-1935. After determining the averages for each year, he found substantial increases in height and weight in the 1935 group as compared to the same measurements for students entering in 1916. The mean increase in height of male students was 1.78 inches (69.23 vs. 67.45 in.) and the mean increase in weight was 9.74 pounds (141.79 vs. 132.05 pounds).

In 1931 MacKinnon and Jackson (6) compared data relative to age, stature, body build, and vital capacity on each of 1205 male students entering the University of Minnesota in 1898-1901 with the data for each of 1810 students entering in 1929. They found there was a significant increase in mean height of .755 inches (68.949 vs. 68.194) in favor of the 1929 group. The mean weight for the 1929 group of 142.072 pounds was 3.9 pounds greater than the mean of 139.172 for the 1898-1901 group. The mean increase of 168 cc. in vital capacity (4354.60 vs. 4186.89) was significant in favor of the 1929 group.

Hooten (5) reported in the *Harvard Alumni Bulletin* that when he compared the records of 1166 fathers who entered the University between the years 1875-1910 with the records of their 1461 sons he found that the latter group averaged 70 inches in height while the mean for fathers was 68.6 inches or a difference of 1.4 inches in favor of the sons.

Deegan (2) did a study on the average age, height and weight of more than 32,000 male students entering Yale University. His first group of 254 students entered the University in 1883 and the final group was composed of 981 students who entered the University in 1941. While all records for each year were considered in a single group, with the range over the years being from 14 years 9 months to 38 years 5 months, his findings showed a gradual but steady trend toward increase in height and weight over the entire period. The mean increase in weight was 13.35 pounds (137.76 vs. 151.11) and the increase in height was 2.29 inches (67.73 vs. 70.02). During the first 10 years the average weight was

*Numbers in parentheses refer to the number of the reference cited in the Bibliography at the end of the report.

135.47 pounds compared to 150.09 for the final 10 years. In height there was an increase from 67.74 for the first 10 years to 69.83 for the last period. Also, in relation to height, his findings show an interesting trend in relation to the per cent of students who were six feet in height or above when entering the University. The increase was from 4.3 per cent for the first year to 22.6 per cent for the final year. When the data from the first and last ten-year periods were compared, the per cent of those who were six feet or taller in height for the first 10 years was found to be 4.5 per cent; for the final period the per cent was 19.8.

While he did not reveal the source of his data, Farmer (4) stated that men entering New England colleges in 1860 averaged 5 feet 7 inches in height and half a century later the average height was 5 feet 9 inches. He also stated that the proportion of six footers among American men was one-third greater than 25 years prior and that draftees in World War II were two-thirds of an inch taller than those of World War I.

Ward, Elbel and Anderson (8) analyzed data relative to 14 bodily measurements shown on the records of 500 students who entered the University of Kansas between the years 1900 and 1925 and compared these findings with measurements of subjects in comparable age groups taken during the academic year 1949-50.

The following were their conclusions:

1. Significant differences in means were obtained on all 14 of the anthropometric measures in favor of the 1949-50 group when compared with the 1900-25 group.

2. Significant differences in means were obtained on all 14 of the anthropometric measures in favor of the 1949-50 group for the age levels 18, 19, 20, and 21, when compared with similar age levels for the 1900-25 group.

3. Significant differences in means were obtained on 10 of the 14 anthropometric measures in favor of the 1949-50 group for the age level 22 when compared with a similar age group for the 1900-25 group. Differences in means were not significant for the following measures: girth of thighs, breadth of shoulders, and breadth of hips.

4. When all subjects were considered as to difference in height and weight, the mean height for the 1949-50 group was 1.92 inches greater than the mean for the 1900-25 group, while the difference in weight was 25.40 pounds in favor of the 1949-50 group.

It is likely that instead of one single factor being responsible for the increase in body size, the result may be due to several factors. Many reasons have been suggested, such as the following: (a) better nutrition in infancy and childhood, (b) less communicable disease among children, (c) general higher standards of living, (d) great advancement in medical science, (e) development of general nutritional knowledge and standards, and (f) favorable climatic conditions. In addition to the above it might be possible that some of the apparent increase in size is due to a greater cross-section of the population entering colleges and universities in recent years.

Mills and Chenoweth (7) consider that the extremely warm climatic conditions are responsible for the cessation of growth. Writing in 1938 after seven years of abnormally high temperatures (starting in 1930) during which time they

observed little change in the mean growth, the authors raised the question as to whether we had not reached our growth peak. They conclude with the following:

> A definite answer to the question "Is the Human Growth Side Turning?" must await the passage of a few more years of careful observation. Present indications are, however, that a growth and development peak has been reached and passed, and that future decades are likely to witness a considerable expansion of the racial recession.
> For several generations children have quite generally exceeded their parents (of like sex) in stature and earliness of puberty onset. This phenomenon seems likely to occur with decreasing frequency in the future. . . . It seems fallacious to consider a projection of this growth trend into an indefinite future. It is more than likely based upon intrinsic forces, over the effects of which man really can exert little influence.

Farmer's (4) observations relative to the cause for the increase in height are interesting. He questions the belief that men are taller because they are better fed, pointing to the fact that the tallest Americans are the mountaineers of Kentucky and North Carolina where dietary conditions are "notoriously inadequate." He puts little faith in greater amounts of outdoor living being the cause for increase in height since tenement dwellers show an increase comparable to others.

Farmer (4) leans toward the beliefs expressed by Mills and Chenoweth (7) that extreme climatic conditions, particularly heat, tend to retard growth while climatic conditions normally found in temperature zones are conducive to increase in height.

In studies such as the present one we are primarily interested in determining whether, over the years, there has been an increase in the measurements in question. It would seem that of equal importance is the determination as to whether the growth trends have followed a definite pattern in which there has been a gradual increase or whether greater acceleration is shown during certain periods. For the purpose of attempting to secure information relative to this point, the data for the present study were grouped by periods according to years.

Also of interest is the extent of correlation between various body measurements. By obtaining the coefficients of correlation between the various measurements of the students entering the University of Kansas during the first period of the study (1898-1907) and comparing these computations with those of students entering during the last period (1948-52) it was hoped that some information might be obtained as to whether there was a significant change over the period of years in the relation between measures.

Statement of the Problem

The study was undertaken in an attempt to learn: (a) whether there have been any significant changes in certain body measurements of male students entering the University of Kansas starting in 1898 through the spring term 1952, (b) whether such changes followed a definite pattern, (c) whether the relationship between the various measurements remained constant over the period involved, and (d) whether the percentage of subjects six feet or greater in height when entering the University changed during the period 1898 through 1952.

Procedure

Physical examination records compiled by Dr. James Naismith, for many years Professor of Physical Education at the University of Kansas, were used as source material for the years from 1898 through 1928. The records from the University Health Service supplied the data for the years 1929 through 1952. While Dr. Naismith secured a large number of measurements, only the following six were consistently secured by the Student Health Service also: height, weight, girth of chest during inspiration, girth of chest during expiration, chest expansion (difference between girth taken during expiration and during inspiration) and girth of waist. Measurements were taken with the subject unclothed. Weight was secured to the nearest one-half pound. Other measurements were taken to the nearest tenth of an inch.

With one exception, random samplings were secured for the 18, 19, 20, 21 and 22 year old students for each five-year period. Since relatively few records were available for the very early age groups, the 441 records were placed in one group for the ten-year period from 1898 through 1907. Otherwise, if the records were available, 300 was considered the maximum sampling for each age group, in each period. In a few instances a larger sampling was used.

All the data for the study can be found in Table 7 on pages 22-24. Statistical procedures were directed toward determining, first, the means and standard deviations for each age group for each period; second, whether there were significant differences between the means for each measurement for the 18 year age group and the other age groups within each period; and third, whether there were significant differences between each age group in the 1898-1907 period and the comparable age group in each of the other periods.

Means and standard deviations were computed by standard procedure. For the purpose of determining whether or not statistical differences existed between the means for the various measures in the various age groups and for the means for the various periods the following formula was employed:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left(\frac{\Sigma x^2_1 + \Sigma x^2_2}{N_1 + N_2 - 2} \right)\left(\frac{1}{N_1} + \frac{1}{N_2} \right)}}$$

Throughout the report only t values at the .01 level of significance or above were considered. The coefficients of correlations were computed by the Pearson Product Moment Method. The z transformation technique (Edwards (3)) was employed for the purpose of determining whether the coefficients of correlation between the various measures taken in the 1898-1907 period were significantly different from the coefficients of correlation for the comparable measurements taken during the 1948-52 period. The following formula was employed:

$$z = \frac{(z'_1 - z'_2) - \overline{z'}}{\sigma z'_1 - z'_2}$$

Results

When the data for all subjects at the various age levels in the 1898-1907 period as compared to those in the 1948-52 period were considered, it will be observed from Table 1 that there was a difference of 1.722 inches in mean height in favor of the data for the subjects in the 1948-52 period (68.233 inches vs. 69.955 inches). It was found that the mean weight for the 1948-52 subjects was 16.201 pounds greater than the mean for the 1898-1907 subjects (139.356 pounds vs. 155.557 pounds). The mean girth of chest during expiration was 2.056 inches greater for the subjects in the 1948-52 period than the mean for the 1898-1907 period (33.093 inches vs. 35.149 inches). The mean girth of chest during inspiration was 1.823 inches less for the 1898-1907 subjects than the mean for the 1948-52 groups (36.227 inches vs. 38.050 inches). In chest expansion (difference between girth of chest during expiration) the mean difference was .243 in favor of the 1898-1907 group (3.109 inches vs. 3.352 inches). The mean girth of waist for the 1898-1907 group was 29.337 inches as compared to 30.001 inches for the mean for the 1948-52 group or a difference of .664 inches in favor of the latter group. It should be noted that the only difference in favor of the 1898-1907 group involved chest expansion. This raises the question as to whether the greater demands placed upon the students in the early groups for more physical activity, such as walking, actually caused that group to develop a greater mean vital capacity than the present day youth. It would appear that, insofar as chest expansion is related to physical development, the 1898-1907 student was better equipped physically for his size than the 1948-52 student.

The means for height and weight for each age group in each period along with the mean measures for all subjects are shown graphically in Figures 1 and 2. It will be noted that for each of these measures, there are not great differences from period to period, but there is considerable difference when the means for the graphs for the final periods are compared to those for the first period.

The means and standard deviations for all measures for all subjects at each age level along with the number of subjects in each category are to be found in Table 7 as previously indicated.

For the purpose of determining whether significant differences existed between the means for the 1898-1907 period and the other periods, the means for all measurements for each age taken during this first period were compared with the means for comparable ages in other periods. Table 2 shows only the significant t values* obtained in this manner.

It will be noted in Table 2 that there were no significant differences between the means for height for the 1898-1907 period and other periods until the 1923-27 period when the t values for the difference for the 19 and 21 year olds were found to be significant. Starting with the 1928-32 period, all t values were significant except for the 22 year old groups when no significant difference was shown until the 1938-42 period.

Reference is also made to Table 2 for significant t values for the means of weight for the different ages in the 1898-1907 period compared to the means for

*Throughout this study only t values at the .01 level or above were considered.

TABLE 1

Means and Difference between Means for Six Bodily Measurements of University of Kansas Male Students from 1898 through 1952

Periods	N	Height	Mean Dif.**	Weight	Mean Dif.	Chest (Expiration)	Mean Dif.	Chest (Inspiration)	Mean Dif.	Chest Expansion	Mean Dif.	Waist	Mean Dif.
1898-07	441	68.233		139.356		33.093		36.227		3.352		29.337	
1908-12	980	68.290	.57	137.990	—1.366	32.972	—.121	36.096	—.121	3.246	.106	29.076	—.261
1913-17	1037	68.244	—.46	140.235	2.446	33.300	.328	36.718	.622	3.501	.255	29.278	.202
1918-22	1063	68.454	.210	139.284	— .950	33.150	—.150	36.649	.069	3.549	.048	29.368	.090
1923-27	1043	68.948	.494	144.184	4.90	33.611	.461	36.749	.100	3.440	—.109	29.519	.151
1928-32	710	68.993	.045	144.639	.455	33.894	.283	37.302	.553	3.494	.054	29.124	—.395
1933-37	1447	69.311	.318	145.133	.498	34.255	.351	37.562	.260	3.571	.077	29.424	.300
1938-42	1401	69.613	.302	146.731	1.598	34.091	—.154	37.392	.170	3.362	—.209	29.354	—.070
1943-47	1144	69.643	.030	153.401	6.670	34.878	.787	37.889	.477	3.165		29.905	.551
1948-52	1487	69.955	.312	155.557	2.156	35.149	.271	38.050	.161	3.109		30.001	.096
Total Difference Between Means for 1948-52 and 1898-1907 periods	10753	1.722		16.201		2.056		1.823		—.243*		.664	

*In favor of 1898-1907 group.

**"Mean Dif." refers to difference between each mean and the mean preceding it.

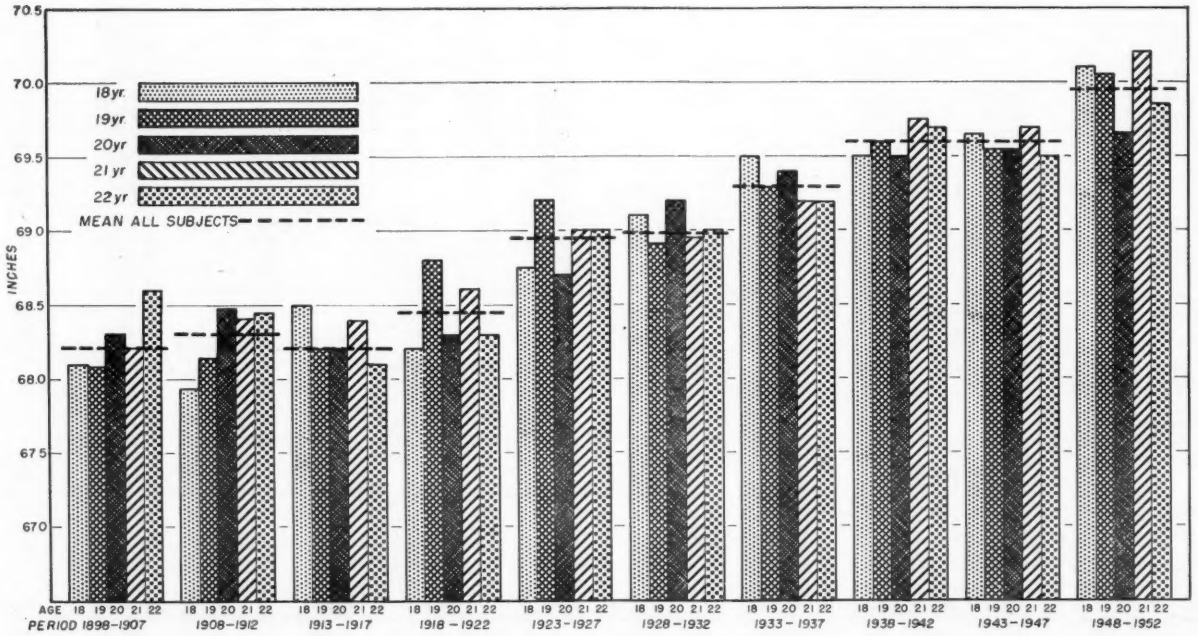

FIGURE 1—*Mean Height of Subjects for Ages 18 through 22 Compared to Means of All Subjects in each of Ten Time Periods Extending from 1898 through 1952.*

TABLE 2

Significant t Values for the Difference between Means of Identical Age Groups in 1898-1907 and Subsequent Time Periods for Six Body Measurements

Age	Period		N	Height M_1*	Height M_2	Height Dif. M_1-M_2	Height t	Weight M_1	Weight M_2	Weight D.f. M_1-M_2	Weight t	Chest (Expiration) M_1	Chest (Expiration) M_2	Chest (Expiration) Dif. M_1-M_2	Chest (Expiration) t
18	1898-07	vs		68.082				135.816				32.765			
	1928-32		329		69.072	.990	3.309		142.749	6.933	3.334		33.625	.860	3.897
	1933-37		398		69.543	1.461	7.233		144.600	8.784	4.551		34.122	1.357	6.401
	1938-42		400		69.490	1.408	4.731		145.820	9.984	4.892				
	1943-47		399		69.742	1.660	5.685		150.532	14.505	6.731		34.370	1.605	7.178
	1948-52		398		70.112	2.030	6.971		155.277	19.461	9.347		34.972	2.207	8.376
19	1898-07	vs		68.075				138.800				32.867			
	1923-27		437		69.223	1.148	3.986		145.189	6.389	3.328		33.752	.885	4.364
	1928-32		301		68.979	.904	3.059						33.515	.648	3.980
	1933-37		413		69.296	1.222	4.548		144.533	5.733	2.907		34.219	1.352	6.494
	1938-42		402		69.610	1.535	5.852		145.761	6.961	3.647		34.211	1.344	6.627
	1943-47		330		69.624	1.549	5.498		154.618	15.818	7.084		34.742	1.866	7.826
	1948-52		414		69.933	1.850	6.832		155.332	16.532	8.456		35.118	2.251	9.587
20	1898-07	vs		68.259				139.772				33.149			
	1923-27		285										33.798	.649	2.699
	1928-32		197		69.219	.960	2.779		146.910	7.188	2.597		33.941	.729	2.763
	1933-37		408		69.116	1.111	3.963						34.136	.987	4.517
	1938-42		408		69.756	1.258	4.608		145.553	5.811	2.647		34.238	1.179	5.159
	1943-47		340		69.709	1.383	4.729		154.619	14.897	5.814		34.928	1.779	7.475
	1948-52		408		69.667	1.408	5.343		156.600	16.828	9.221		35.278	2.129	8.983
21	1898-07	vs		68.117				142.206				33.463			
	1923-27		287		68.998	.821	2.694								
	1928-32		274		68.972	1.795	5.333						34.250	.787	2.937
	1933-37		371		69.116	.939	3.228						34.208	.745	3.162
	1938-42		378		69.517	1.579	5.142						34.253	.790	3.243
	1943-47		275		69.709	1.533	5.123		155.800	13.594	5.755		35.039	1.577	5.915
	1948-52		367		70.207	2.030	6.949		155.566	13.360	6.261		35.180	1.717	7.139
22	1898-07	vs		68.574				140.240				33.223			
	1928-32		150										34.139	.916	2.974
	1933-37		298						147.581	7.341	3.292				
	1938-42		274		69.691	1.117	2.819						34.733	1.510	5.543
	1943-47		241		69.498	1.265	3.142		151.738	14.505	6.034		34.878	1.655	5.746
	1948-52		341		69.856	1.282	3.323		155.014	14.808	6.079		35.201	1.978	7.074

*Mean for 1898-1907 Period is always M_1.

Age	Period		N	Chest (Inspiration) M_1	Chest (Inspiration) M_2	Chest (Inspiration) Dif. M_1-M_2	Chest (Inspiration) t	Chest Expansion M_1	Chest Expansion M_2	Chest Expansion Dif. M_1-M_2	Chest Expansion t	Waist M_1	Waist M_2	Waist Dif. M_1-M_2	Waist t
18	1898-07	vs		34.347				1.582				27.000			
	1928-32		329		35.297	.950	3.744		1.672	.090	1.000		27.375	.375	2.000
	1933-37		398		35.000	.653	2.878		1.878	.296	2.000		27.500	.500	2.000
	1938-42		400												
	1943-47		399		35.000	.653	2.878		1.630	.048	1.000		27.500	.500	2.000
	1948-52		398		35.000	.653	2.878		1.630	.048	1.000		27.500	.500	2.000
19	1898-07	vs		34.500				1.633				27.000			
	1923-27		437		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1928-32		301		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1933-37		413		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1938-42		402		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1943-47		330		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1948-52		414		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
20	1898-07	vs		34.500				1.633				27.000			
	1923-27		285												
	1928-32		197		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1933-37		408		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1938-42		408		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1943-47		340		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1948-52		408		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
21	1898-07	vs		34.500				1.633				27.000			
	1923-27		287												
	1928-32		274		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1933-37		371		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1938-42		378		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1943-47		275		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1948-52		367		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
22	1898-07	vs		34.500				1.633				27.000			
	1928-32		150												
	1933-37		298												
	1938-42		274		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1943-47		241		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000
	1948-52		341		35.000	.500	2.000		1.630	.003	1.000		27.500	.500	2.000

*Mean for 1898-1907 Period is always M_1.

Age	Period		N	Chest (Inspiration) M_1*	M_2	Dif. M_1-M_2	t	Chest Expansion M_1	M_2	Dif. M_1-M_2	t	Waist M_1	M_2	Dif. M_1-M_2	t
18	1898-07	vs		35.878				3.215				28.758			
	1908-12		338		35.150	.728	3.183								
	1928-32		329		37.013	1.155	4.942								
	1933-37		398		37.392	1.514	6.844		3.518	.303	3.045				
	1938-42		400		37.149	1.271	5.749		3.255	.400	4.082				
	1943-47		399		37.246	1.368	6.048						29.487	.729	3.169
	1948-52		398		37.885	2.007	8.397		3.078	.137	1.957		29.911	1.133	4.572
19	1898-07	vs		36.295				3.378				29.316			
	1908-12		394						3.063	.315	3.200				
	1923-27		437		36.975	.716	3.421		3.651	.273	2.879				
	1928-32		301		37.025	.766	3.417								
	1933-37		413		37.528	1.269	5.714		3.582	.204	3.328				
	1938-42		402		37.167	.908	4.223								
	1943-47		330		37.574	1.315	5.152						29.814	.498	5.999
	1948-52		414		37.954	1.695	7.747		3.006	.372	4.079				
20	1898-07	vs		36.386				3.384				29.294			
	1918-22		348		36.963	.577	3.144								
	1923-27		285		36.977	.519	2.814								
	1928.32		197		37.435	1.049	3.707								
	1933-37		408		37.452	1.066	4.552								
	1938-42		408		37.576	1.190	4.975								
	1943-47		340		38.308	1.922	7.598								
	1948-52		408		38.168	1.782	7.691						30.407	1.113	4.077
21	1898-07	vs		36.279				3.471				29.838			
	1913-17		336		37.119	.840	2.763								
	1918-22		277		37.075	.796	2.796								
	1928-32		274		37.458	1.179	3.406								
	1933-37		371		37.467	1.188	4.849								
	1938-42		378		37.372	1.093	4.365								
	1943-47		275		37.909	1.574	5.787								
	1948-52		367		38.099	1.820	7.552		3.147	.324	2.569				
22	1898-07	vs		36.335				3.314				29.482			
	1913-17		137		37.375	1.040	3.489								
	1928-32		150		37.583	1.248	3.937								
	1933-37		298		37.972	1.637	6.041								
	1938-42		274		37.695	1.360	4.963								
	1943-47		241		38.408	2.073	7.667						30.281	.799	2.572
	1948-52		341		38.145	1.810	7.667						30.313	.831	3.208

*Mean for 1898-1907 Period is always M_1.

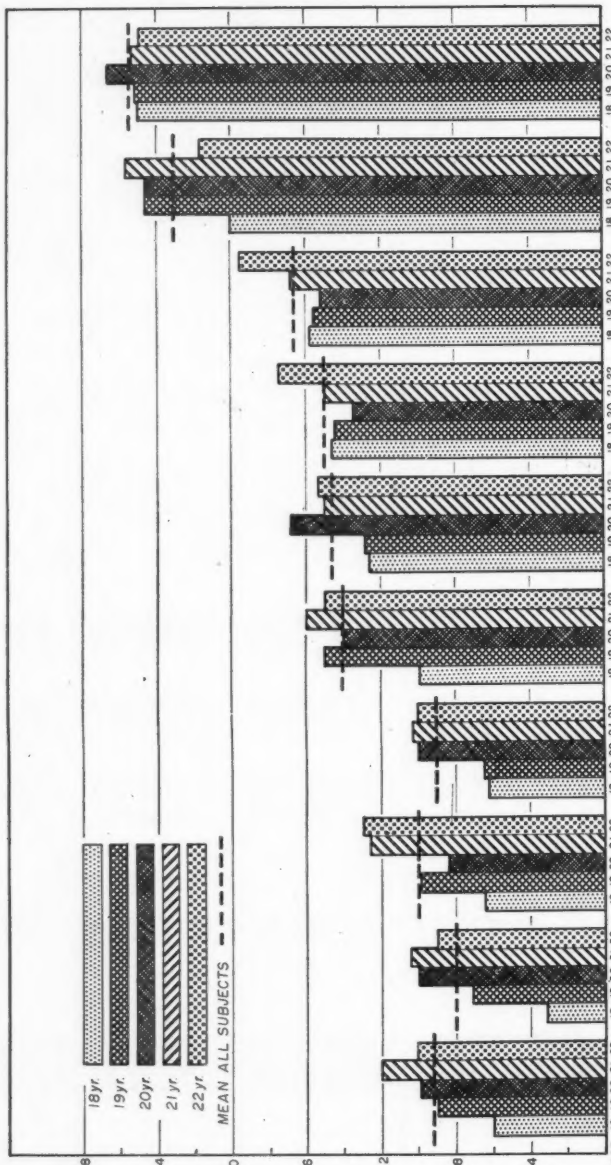

FIGURE 2—*Mean Weight of Subjects for Ages 18 through 22 Compared to Means of All Subjects in Each of Ten Time Periods Extending from 1898 through 1952.*

other periods. These means follow a similar, but not identical, pattern with those for height in that there was no significant difference at any age level until the 1923-27 period when the difference for the 19 year olds was significant. The consistency in significance did not appear until the 1943-47 period although there was a definite trend prior to that time.

The difference between the mean girth of the chest during inspiration for the 1898-1907 period when compared to the mean for the other periods shows a definite pattern which became well established with the 1928-32 period. All *t* values for all ages from this period on were significant in favor of the later groups.

In the mean girth of chest during expiration there was a definite trend toward significant *t* values in favor of the later groups from the 1929-32 period through 1948-52 period except the 22 year olds in the 1933-37 period and the 18 year olds in the 1938-42 period.

In chest expansion (difference between girth of chest during inspiration and expiration), Table 2 shows that when the *t* values were computed for the difference between the means for the 1898-1907 period and the means for age groups in the other periods, there were some significant *t* values but they were too scattered to be considered as a definite trend.

In girth of waist there were but six *t*'s significant at the .01 level or above. These were all in favor of ages in the last two periods of study: the *t*'s for the 18 and 19 year olds during the 1943-47 period and those for the 18, 19, 20, and 22 year olds in the 1948-52 period were significantly greater than the comparable measures for the 1898-1907 period. This might indicate that there will be a trend toward increase in waist size in years to come.

A different type of comparative evidence is presented in Table 3. Here it will be noted that relatively few *t* values computed from the difference between means for height and weight for identical age groups starting with the 1898-1907 period were found to be significant. The lack of consistency in the significant *t* values would seem to indicate that, in general, the mean increase in height and weight was too gradual to show significant differences between means for successive periods. The gradual increase in size of the means for successive periods over that for the 1898-1907 period caused the start of a definite trend with the 1928-32 period.

To continue the analysis still further, the *t* values were computed for the 18 year olds as compared to the means for the other ages within each period. The significant *t* values are to be found in Table 4. In height, values at the .01 level or above were found in only three instances. Under the circumstances, it is safe to state that, within the limits of these samplings, the student had reached his maximum height at 18 years of age. The data indicated that particularly after the 1928-32 period there was a trend toward no significant differences in the mean weight of the 18 year olds and the means for subjects in the other age groups.

While there were numerous significant *t* values for the difference between the mean girth of chest during expiration for the 18 year olds versus the other age groups, the differences were all in favor of the older groups. Except for the

TABLE 3

Significant t Values for the Difference between Means for Height and Weight for Each Age Group Compared to the Means for Identical Age Groups in the Subsequent Time Period

Age	Periods	M_1	M_2	Dif.	*t*
	Height				
18	1908-'12 vs 1913-'17	67.917	68.467	.550	2.594
19	1913-'17 vs 1918-'22	68.174	68.806	.632	2.988
18	1918-'22 vs 1923-'27	68.207	68.763	.556	2.771
19	1918-'22 vs 1923-'27	67.174	69.223	.559	2.666
20	1928-'32 vs 1933-'37	68.219	69.369	1.150	4.064
21	1933-'37 vs 1938-'42	69.116	69.756	.640	2.933
21	1943-'47 vs 1948-'52	69.709	70.207	.498	2.935
	Weight				
22	1898-'07 vs 1908-'12	140.240	139.180	1.060*	4.232
19	1913-'17 vs 1918-'22	139.880	136.654	3.226*	2.575
19	1918-'22 vs 1923-'27	136.654	145.189	8.535	5.783
21	1918-'22 vs 1923-'27	141.570	146.324	4.754	2.706
20	1933-'37 vs 1938-'42	143.629	145.533	5.533	3.524
19	1938-'42 vs 1943-'47	145.761	154.618	8.857	4.462
20	1938-'42 vs 1943-'47	145.533	154.619	9.086	4.951
21	1938-'42 vs 1943-'47	146.932	155.800	7.687	3.934
22	1938-'42 vs 1943-'47	149.609	151.738	2.129	2.623

*Difference in favor of the 18 year Age Group. All other means were in favor of age groups above 18.

1908-12 and the 1938-42 periods, there was no definite consistency. All *t*'s were significant for the 1908-12 period and the 1938-42 periods, but no such differences were found for the 1948-52 period. The *t* values for the differences for the girth of chest during inspiration showed some similarity but even less consistency.

The differences in means between the 18 year olds and the other age groups for the girth of the waist showed a greater trend toward significant *t*'s than the girth of chest during expiration and the girth during inspiration, but no such values were found for the 1948-52 period.

In the difference between the mean chest expansion (difference between the girth of the chest inspiration and expiration) for the 18 year olds when compared to the other age groups, there were but three *t* values which were significant at the .01 level or greater.

It is interesting to note that, considering all measurements, in no instance was there a single significant *t* value for means of the 18 year olds compared to the means for any of the other ages during the 1948-52 period. Whether this is an indication of a trend toward earlier physical maturity remains to be seen.

For the purpose of determining the extent of comparison between the various measures taken during the 1898-1907 period, coefficients of correlation were computed between each of the measures for each age group. The same procedure was followed for the measurements taken during the 1948-52 period. The coefficients of correlation are shown in Table 5.

TABLE 4

Significant t Values for the Difference between Means for the 18 Year Age Group and the Other Age Groups in Each Time Period for Six Body Measurements

			Height				Weight				Chest (Expiration)			
Ages	Period	N	M_1	M_2	Dif. M_1-M_2	t	M_1	M_2	Dif. M_1-M_2	t	M_1	M_2	Dif. M_1-M_2	t
18-21	1898-1907	166					**138.800**	142.206	6.390	2.868	32.765	33.463	.698	2.585
18-19	1908-1912	521					**133.009**	137.330	6.171	2.810	32.331	32.926	.595	3.951
18-20	1908-1912	472	67.917	68.489	.572	2.717					32.331	33.241	.910	6.026
18-21	1908-1912	400					**133.009**	140.500	6.926	4.372	32.331	33.331	1.000	5.811
18-22	1908-1912	307					**133.009**	139.180	4.821	2.592	32.331	33.034	.703	3.576
18-21	1913-1917	444					**136.564**	142.750	6.186	3.876	32.836	33.788	.952	5.321
18-22	1913-1917	332					**136.564**	143.410	6.846	3.618	32.838	33.824	.988	4.617
18-19	1918-1922	492	68.207	68.806	.599	2.878								
18-20	1918-1922	486					**136.428**	141.402	4.974	3.048	32.881	33.412	.531	2.814
18-21	1918-1922	455					**136.428**	141.570	5.142	3.370				
18-19	1923-1927	564					**139.834**	145.189	5.355	3.374	33.160	33.752	.592	3.442
18-20	1923-1927	417									33.160	33.798	.638	3.255
18-21	1923-1927	469					**139.834**	146.324	6.490	3.706	33.160	33.752	.592	3.420
18-21	1928-1932	337	69.072	68.972	.90	**3.291**								
18-22	1933-1937	544									34.211	34.594	.472	3.246
18-19	1938-1942	519									33.062	34.211	1.149	6.286
18-20	1938-1942	602									33.062	34.238	1.176	6.125
18-21	1938-1942	592									33.062	34.253	1.191	6.285
18-22	1938-1942	523									33.062	34.733	1.671	8.631
18-20	1943-1947	533									34.370	34.928	.558	2.847
18-21	1943-1947	508					**150.321**	155.800	5.479	2.670	34.370	35.039	.669	3.163

			Chest (Inspiration)				Chest Expansion				Waist			
18-22	1898-1907	211									28.316	29.482	.732	2.630
18-19	1908-1912	521	35.150	35.941	.719	4.596					28.354	29.014	.660	3.813
18-20	1908-1912	472	35.150	36.417	1.267	7.669					28.354	29.336	.982	5.419
18-21	1908-1912	400	35.150	**36.626**	1.476	7.398					28.354	29.419	1.065	5.547

TABLE 4 (continued)

			Chest (Inspiration)				Chest Expansion				Waist			
Ages	Period	N	M_1	M_2	Dif. M_1-M_2	t	M_1	M_2	Dif. M_1-M_2	t	M_1	M_2	Dif. M_1-M_2	t
18-22	1908-1912	307	35.150	36.347	1.197	4.442					28.354	29.261	.907	3.927
18-20	1913-1917	493	36.165	36.584	.419	2.585								
18-21	1913-1917	444	36.165	37.119	.954	3.739					28.774	29.708	.934	4.320
18-22	1913-1917	332	36.165	37.375	1.210	5.470	3.494	3.659	.165	2.619	28.774	29.693	.919	3.789
18-20	1918-1922	486	36.152	36.963	.811	4.424					28.871	29.131	.924	4.411
18-21	1918-1922	455	36.152	37.075	.923	5.329					28.871	29.617	.746	4.043
18-22	1918-1922	369									28.871	29.428	.557	2.609
18-19	1923-1927	564	36.383	36.975							28.949	29.731	.782	4.614
18-20	1923-1927	477	36.383	36.977							28.949	29.517	.568	3.029
18-21	1923-1927	469									28.949	29.546	.597	3.074
18-22	1923-1927	313									28.949	29.855	.906	3.458
18-20	1928-1932	410									28.832	29.974	.915	3.121
18-21	1928-1932	337									28.832	29.516	.734	2.864
18-22	1928-1932	327									28.832	29.532	.700	2.646
18-21	1933-1937										29.118	29.678	.560	3.262
18-22	1933-1937	544	37.392	37.972	.580	3.105	3.518	3.622	.104	1.383	29.118	29.726	.608	3.086
18-20	1938-1942	602					3.255	3.488	.233	3.411				
18-20	1943-1947	533	37.246	38.308	1.062	4.879								
18-21	1943-1947	508	37.246	37.909	.663	3.249					29.487	30.149	.622	2.942
18-22	1943-1947	489	37.246	38.408	1.162	6.257					29.487	30.281	.749	3.052

When height and weight for the 1898-1907 period were compared, coefficients of correlation were found to be significant at the .01 level or above for all ages except for the 22 year olds. Height when compared to girth of chest during inspiration resulted in but two significant r's (19 and 20 year groups). Three of the five r's for chest expansion compared to height were insignificant. In short, there was more consistency found in significance of coefficients of correlation between height and weight than the other r's involving height. Consistently significant coefficients of correlation were found between weight and girth of chest during inspiration and weight and girth of chest during expiration.

Significant r's were found between the girth of chest during expiration and the girth during inspiration. Very little relationship was found between chest expansion and other measures based on the fact that there were but a few significant r's when this measure was compared with the others.

Again Table 5 shows that for the 1948-52 period the trend of the coefficients of correlation was very similar to those obtained from the data for the 1898-1907 period except that none of the r's involving chest expansion was significant.

As previously explained, the z transformation technique (Edwards (3)) was employed for the purpose of determining whether significant differences existed between the coefficients of correlation computed from the data obtained during the 1898-1907 period and those secured for the 1948-52 period. There were several z's that reached the .01 level or greater. All differences were in favor of the 1948-52 group. Using significant z's as a basis, it was concluded that there was a greater relationship between the data for the following measures secured during the 1948-52 period than for the data on the same measures secured during the 1898-1907 period: weight compared to girth of chest during expiration; weight compared to girth of waist; and girth of chest during inspiration compared to the girth of chest during expiration.

Height alone is frequently used as an index of change in growth during various periods. The arbitrary height of six feet has been used as a standard. Deegan (2) and Farmer (4), previously mentioned, refer to the percentage of students who were six feet or greater in height when entering the university. This procedure was followed in the present study.

Table 6 shows the percentages of students in each age level in each period who were six feet or greater in height when entering the University of Kansas. The percentages for all subjects in each period are also shown. These data are also shown graphically in Figure 3. There are some striking contrasts in the percentages. With the exception of one age group (21 year olds) the percentage of six footers was greater for the 1898-1907 period than for the 1908-12 period. However, when all subjects are considered, one finds that starting with the 1913-17 period there was a steady increase from 5.7 per cent to 15.5 per cent through the 1933-37 period, then a drop to 14.4 per cent for the 1938-42 period, followed by an increase to 19.69 per cent for the final period. The greatest percentage was shown for the 18 year age group for the 1948-52 period when 25 per cent were six feet or taller when entering the University. It is interesting that the second highest per cent was 22.9 per cent for the 19 year age group during the same period. These figures compared with 14.0, 20.7 and 16.0 per cent for the 20, 21 and 22 age groups would seem to indicate another trend in increase in height. However, such conclusions must await the gathering of additional data during future periods. The smallest per cent of six-footers (1.5 per cent) was found for the 21 year age group during the 1898-1907 period. The

TABLE 5

z Values for the Difference between Coefficients of Correlation Among Six Body Measurements

Measurements	Age	r_1	z'_1	r_2	z'_2	Dif. Between z'_1-z'_2	$\sigma z'_1$-z'_2	z
				Height				
	18	.528*	.662	.129	.131	.531	.1175	4.519**
	19	.593*	.685	.496*	.543	.142	.1133	1.267
Weight	20	.523*	.583	.459*	.497	.086	.1131	.760
	21	.384*	.406	.359*	.376	.030	.1367	.219
	22	.187	.187	.379*	.400	.213	.1521	1.400
	18	.147	.146	.264*	.271	.073	.1175	.621
	19	.309*	.321	.298*	.307	.014	.1113	.126
Chest	20	.417*	.442	.339*	.353	.089	.1131	.787
(Inspiration)	21	.135	.136	.231	.236	.100	.1367	.732
	22	.278	.282	.219	.224	.058	.1521	.381
	18	.378*	.400	.178	.178	.222	.1175	1.889
	19	.026	.025	.188	.187	.162	.1113	1.455
Chest	20	.210	.208	.294*	.302	.094	.1131	.831
(Expiration)	21	.168	.167	.227	.229	.062	.1367	.454
	22	.202	.224	.158	.357	.133	.1521	.874
	18	.295*	.234	.141	.141	.093	.1175	.791
	19	.104	.105	.022	.022	.073	.1113	.656
Chest	20	.225	.229	.185	.187	.042	.1131	.371
Expansion	21	.018	.017	.146	.146	.130	.1367	.951
	22	.313*	.321	.128	.129	.192	.1521	1.262
	18	.235	.239	.199	.201	.038	.1175	.323
	19	.255*	.261	.279*	.285	.024	.1113	.212
Waist	20	.262*	.266	.276*	.283	.017	.1131	.150
	21	.103	.103	.159	.159	.056	.1367	.409
	22	.142	.142	.151	.152	.010	.1521	.066
				Weight				
	18	.831*	1.188	.737*	.942	.246	.1175	2.093
	19	.490*	.455	.608*	.704	.249	.1113	2.237
Chest	20	.904*	1.499	.816*	1.146	.353	.1131	3.121**
(Inspiration)	21	.659*	.787	.763*	1.000	.213	.1367	1.558
	22	.796*	1.087	.887*	1.412	.325	.1521	2.136
	18	.740*	.950	.897*	1.460	.570	.1175	4.851**
	19	.581*	.663	.816*	1.148	.485	.1113	4.357**
Chest	20	.743*	.962	.901*	1.472	.510	.1131	4.509**
(Expiration)	21	.706*	.887	.746*	.965	.078	.1367	.570
	22	.856*	.896	.886*	1.400	.504	.1521	3.313**
	18	.195	.198	.059	.059	.139	.1175	1.182
	19	.073	.073	.016	.016	.057	.1113	.512
Chest	20	.193	.196	.056	.056	.140	.1131	1.237
Expansion	21	.147	.148	.100	.100	.048	.1367	.351
	22	.097	.097	.009	.009	.087	.1521	.571

TABLE 5 (continued)

Measurements	Age	r_1	z'_1	r_2	z'_2	Dif. Between z'_1-z'_2	$\sigma z'_1$-z'_2	z
				Weight (continued)				
	18	.702*	.869	.842*	1.230	.361	.1175	3.072**
	19	.707*	.878	.839*	1.221	.343	.1113	3.081**
Waist	20	.698*	.811	.859*	1.239	.482	.1131	4.261**
	21	.763*	.877	.803*	1.116	.234	.1367	1.748
	22	.573*	.615	.837*	1.230	.515	.1521	3.385**
				Chest (Inspiration)				
	18	.834*	1.204	.823*	1.160	.044	.1175	.374
	19	.718*	.817	.860*	1.293	.476	.1113	4.276**
Chest	20	.821*	1.160	.816*	1.142	.018	.1131	.159
(Expiration)	21	.730*	.929	.935*	1.697	.568	.1367	4.155**
	22	.730*	.929	.870*	1.333	.404	.1521	2.656**
	18	.248	.252	.178	.180	.072	.1175	.612
	19	.269*	.276	.222	.226	.050	.1113	.449
Chest	20	.499*	.548	.176	.178	.370	.1131	3.271**
Expansion	21	.407*	.434	.287	.477	.043	.1367	.314
	22	.339	.354	.257	.263	.091	.1521	.598
	18	.433*	.463	.670*	.832	.369	.1175	3.140**
	19	.609*	.709	.607*	.549	.160	.1113	1.437
Waist	20	.536*	.597	.747*	.528	.069	.1131	.610
	21	.667*	.805	.755*	.923	.118	.1367	.863
	22	.634*	.748	.828*	.459	.289	.1521	1.900
				Chest (Expiration)				
	18	.019	.019	−.016	.016	.003	.1175	.025
	19	.127	.128	−.134	.136	.008	.1113	.071
Chest	20	.010	.010	−.088	.088	.078	.1131	.689
Expansion	21	.092	.091	−.141	.142	.051	.1367	.373
	22	.106	.108	−.075	.075	.033	.1521	.216
	18	.683*	.832	.802*	1.100	.047	.1175	2.281
	19	.499*	.549	.826*	1.160	.462	.1113	5.489**
Waist	20	.557*	.528	.743*	.955	.260	.1131	3.779**
	21	.727*	.923	.642*	.726	.002	.1367	1.440
	22	.429*	.459	.660*	.793	.026	.1521	2.193
				Chest Expansion				
	18	.124	.125	−.078	.078	.047	.1175	.400
	19	.045	.048	−.023	.023	.426	.1113	3.827**
Waist	20	.258*	.264	.004	.004	.260	.1131	2.298
	21	.027	.027	.025	.025	.002	.1367	.014
	22	.001	.001	.028	.027	.026	.1131	.170

*Indicates r significant at .01 level or above.

**Indicates Z significant at .01 level or above.

Note: Coefficients of correlation between measurements for the 1898-1907 period are shown as r_1. The r's for the 1948-52 period are shown as r_2. z_1 refers to the value of r_1. z_2 refers to the value of r_2. The difference between z_1 and z_2 and σz_1-z_2 appear in separate columns.

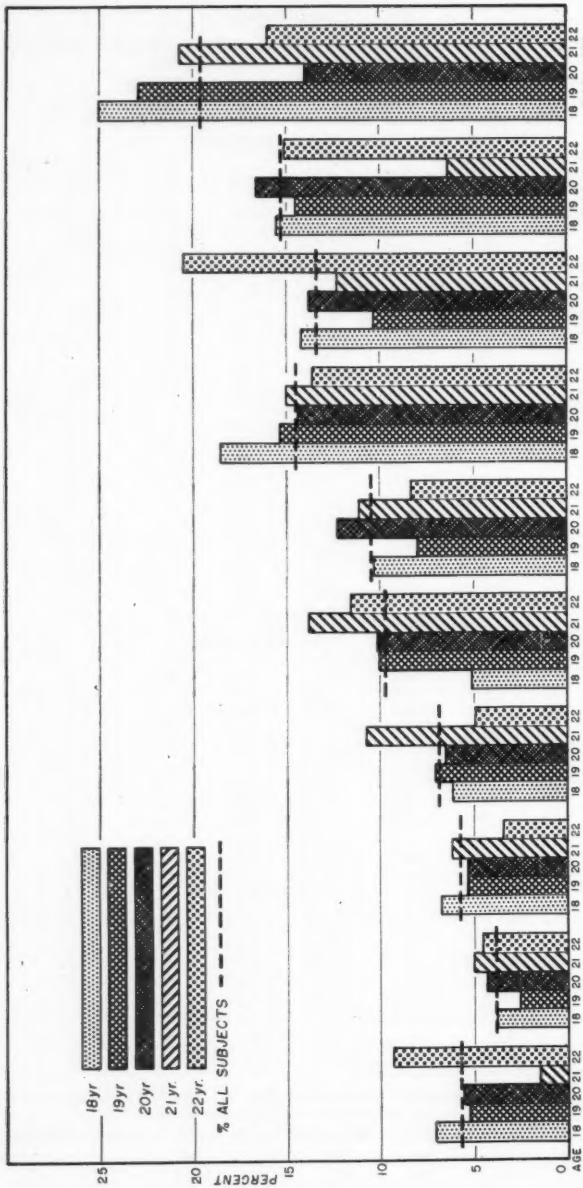

FIGURE 3—*Percentage of Subjects for Ages 18 through 22 Who Were Six Feet or Taller in Height When Entering the University of Kansas between 1898 and 1952.*

TABLE 6

The Percentage of Male Students Entering the University of Kansas from 1898 through 1952 Who Were Six Feet or Over in Height

Periods	Age 18	19	20	21	22	All
1898-07	7.1	5.3	5.6	1.5	9.3	5.7
1908-12	3.8	2.5	4.3	5.0	4.5	3.8
1913-17	6.7	5.3	5.3	6.1	3.4	5.7
1918-22	6.1	7.0	6.5	10.7	4.9	6.9
1923-27	5.1	10.0	10.1	13.8	11.5	9.7
1928-32	10.3	8.0	12.3	11.1	8.3	10.2
1933-37	18.5	15.3	14.4	15.0	13.6	15.5
1938-42	15.2	11.3	13.8	13.3	20.5	14.4
1943-47	16.5	15.5	17.6	6.4	15.1	16.3
1948-52	25.0	22.9	14.0	20.7	16.0	19.69

large number of 21 year olds in the service probably accounted for the small percentage (6.4) of six-footers during the 1943-47 period.

DISCUSSION

Comparisons between the present study and similar studies are limited due to the difference in age limits of subjects. In the present study, it was decided to use data for subjects who were, when entering the University, in the more common age groups (18, 19, 20, 21, and 22 years of age). Deegan (2) used the records of 32,000 students entering Yale University between the years 1883 and 1941. The range of age of his subjects was from 14 years 9 months to 38 years 5 months. He found an overall mean gain in weight of 13.35 pounds for the entire period. Computed from Table 1 in the present study, the increase in weight from 1898 through 1942 (Deegan's study was reported in 1941) was 7.375 pounds. The mean increase for the period from 1943 through 1952 was 8.826 pounds. It is quite probable that the larger mean weight secured by Deegan was, at least in part, due to the inclusion of data obtained from subjects which were older than the upper age limits of subjects used for the present study. Insofar as weight was concerned, the smaller samplings used by Ward, Elbel and Anderson (8) were apparently not entirely adequate since the mean difference in weight for these subjects was 25.40 pounds greater for the 1949-50 group than the mean for the 1900-25 group. The mean increase in weight from the first through the final period of the present study was 16.201 pounds.

As to increase in height, it is interesting to reflect upon a point raised by Mills and Chenoweth (7) relative to the effect of extreme climatic conditions as a factor in retarding growth. Writing in 1938, these authors raised the question as to whether the increased height had not actually been attained. It is interesting that the mean height for the first group in the present study was 68.233 inches and the average height for the next five periods (ending with the 1932 period) was 68.585 inches which was a mean increase of .352 inches attained to the early years of an extremely hot period. The mean height starting with the 1933-37 period to the conclusion of the present study showed a mean of 69.631 inches or an increase of 1.046 inches over the mean for all subjects from the 1908-12

through the 1928-32 period. This would show that, if these data are representative, the question raised by Mills and Chenoweth can be answered in the negative since there was a pronounced increase in height for the periods following the 1928-32 period.

The mean height shown by Deegan at the conclusion of his study (1941) 69.83 compares very favorably with the means of 69.61 obtained in the present study.

McKinnon and Jackson (6) found a mean increase in height of 1.78 inches in height for the period between 1916 through 1935. The increase for a comparable period in the present study was 1.369 inches.

While there is a significant coefficient of correlation between height and weight, it is interesting to note that the greatest increase in mean height for one period as compared to the preceding one was .494 inches for the 1923-27 period. The greatest mean increase in weight for any period over the preceding one did not occur until 1943-47 when the mean was 6.670 pounds greater than the mean for the 1938-42 period.

The percentage of students six feet in height or greater when entering the University was found by Deegan (2) to be 19.8 per cent for the final period of his study. This was almost identical with the percentage, 19.69, obtained in the present study for the subjects in the 1948-52 period as shown in Table 6. It is of interest to note that there was a steady increase in the percentage for all subjects following the 1908-12 period with the exception of a slight decrease during the 1938-42 period. The fact that the data for 18 year olds for the 1948-52 period showed the highest percentage (25) and the data for the 19 year olds revealed the second highest percentage (22.9) may be a definite trend in the direction of increasingly taller students entering the University of Kansas in years to come.

Summary and Conclusions

The data relative to anthropometric measurements of students entering the University of Kansas during the period from 1898 through 1907 were compared with the data for students entering the University during successive periods extending through the academic year 1952. Comparisons were made in the following four respects: (1) the difference between means of measurements for comparable age-groups; (2) the correlation between the different measurements obtained during the 1898-1907 period and those secured during the 1948-52 period; (3) the difference between coefficients of correlation between measurements taken during the 1898-1907 period and those taken during the 1948-52 period; and (4) the percentage of subjects six feet or greater in height during each period. On the basis of the data it was concluded that:

1. The students entering the University during the 1948-52 period were, on the average, 1.722 inches taller, were 16.201 pounds heavier, had a 2.056 inch greater mean chest girth during expiration, had a 1.823 inch greater mean girth of chest during inspiration, and, had a .664 inch greater girth of waist than the students entering during the 1898-1907 period. The difference between the mean chest expansion for the 1898-1907 vs. 1948-52 periods was .243 inches which was the only difference in favor of the subjects in the 1898-1907 period.

2. In general, the definite trend of significant *t* values* for the difference between the means for groups in other periods compared to those for the 1898-1907 period was not found until about the 1923-27 period for all measurements except the girth of waist, for which there was no definite trend until the 1943-47 period, and chest expansion, for which no definite trend was found.

3. It was concluded that, since there was no consistent trend in significant *t* values (particularly after the 1928-32 period), subjects, had at 18 years of age, reached their growth in height and weight and had reached their peak in chest expansion. There was a tendency for increase in chest girth during inspiration, girth of chest during expiration, and girth of waist for the older age levels.

4. Significant coefficients of correlation were quite generally found for both the 1898-1907 period and the 1948-52 period for the following measures:

a. Height vs. weight
b. Weight vs. girth of chest during inspiration
c. Weight vs. girth of chest during expiration
d. Weight vs. girth of waist
e. Girth of chest during inspiration vs. girth during expiration
f. Girth of chest during inspiration vs. girth of waist
g. Girth of chest during expiration vs. girth of waist

5. Based upon significant z values, it was concluded that there was a greater relationship between the following measurements taken during the 1948-52 period than between the same measurements taken during the 1898-1907 period: weight and girth of chest during expiration; weight and girth of waist; girth of chest during inspiration and girth during expiration.

6. There was an increase in the percentage of students who were six feet in height or taller when entering the University, from 3.8 per cent during the 1908-12 period to 19.69 per cent during the 1948-52 period.

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*Only *t* values at the .01 level or above were considered.

TABLE 7

Means and Standard Deviations for Six Body Measurements for All Subjects by Age Groups during Ten Different Time Periods

Age	N	Height Mean	Height SD	Weight Mean	Weight SD	Chest (Expiration) Mean	Chest (Expiration) SD	Chest (Inspiration) Mean	Chest (Inspiration) SD	Chest Expansion Mean	Chest Expansion SD	Waist Mean	Waist SD
1898-1907													
18	98	68.082	2.570	135.816	16.37	32.765	1.80	35.878	1.865	3.215	.8505	28.758	1.750
19	113	68.075	2.430	138.800	16.54	32.867	1.725	36.259	1.852	3.378	.8465	29.316	2.195
20	108	68.259	2.487	139.722	19.26	33.149	1.908	36.386	2.053	3.384	.9810	29.294	2.225
21	68	68.177	2.030	142.205	14.74	33.463	1.692	36.279	1.742	3.471	.9660	29.838	1.827
22	54	68.574	2.645	140.240	13.40	33.223	1.728	36.335	1.679	3.314	1.0425	29.482	1.58
Average		68.2334		139.356		33.093		36.227		3.352		29.337	
TOTAL	441												
1908-1912													
18	240	67.917	2.365	133.009	20.51	32.331	1.663	35.150	2.012	3.145	.9135	28.354	1.826
19	281	68.148	2.354	137.330	19.86	32.926	1.795	35.941	1.940	3.063	.9830	29.014	2.125
20	232	68.489	2.210	139.935	13.26	33.241	1.582	36.417	1.632	3.196	.8980	29.336	2.095
21	160	68.413	2.315	140.500	16.26	33.331	1.708	36.626	1.923	3.353	.966	29.419	1.915
22	67	68.483	2.482	139.180	14.35	33.034	1.350	36.347	1.933	3.474	.895	29.261	1.820
Average		68.290		137.990		32.972		36.096		3.246		29.076	
TOTAL	980												
1913-1917													
18	244	68.467	2.295	136.564	14.95	32.836	1.656	36.165	1.739	3.494	.9685	28.774	2.261
19	252	68.174	2.235	139.880	12.92	32.963	1.628	36.348	1.675	3.479	.9725	28.980	1.658
20	253	68.184	2.405	138.571	16.65	33.091	1.806	36.584	1.868	3.427	.9300	29.236	1.820
21	200	68.365	2.395	142.750	18.21	33.788	2.038	37.119	2.302	3.448	1.0650	29.708	2.305
22	88	68.057	2.34	143.410	15.40	33.824	1.745	37.375	1.795	3.659	.0885	29.693	1.828
Average		68.244		140.235		33.300		36.718		3.501		29.278	
TOTAL	1037												

						1918-1922							
18	246	68.207	2.253	136.428	16.15	32.881	1.795	36.152	1.925	3.417	.976	28.871	1.995
19	245	68.806	2.364	136.654	14.90	33.085	1.813	36.521	1.848	3.519	1.051	29.131	1.976
20	240	68.342	2.281	141.402	19.62	33.412	2.323	36.963	2.107	3.598	.992	29.795	2.585
21	209	68.644	2.524	141.570	16.31	33.048	1.785	37.075	1.790	3.602	1.043	29.617	1.903
22	123	68.272	2.340	140.336	16.21	33.324	1.755	36.536	1.855	3.613	1.013	29.428	1.901
Average		68.454		139.284		33.150		36.649		3.549		29.368	
TOTAL	1063												
						1923-1927							
18	240	68.763	2.163	139.834	17.31	33.160	1.888	36.383	2.005	3.369	.900	28.949	1.805
19	324	69.223	3.156	145.189	20.32	33.752	2.199	36.975	2.094	3.651	.928	29.731	2.21
20	177	68.709	2.974	144.163	21.57	33.798	2.049	36.977	2.265	3.412	.903	29.517	1.955
21	229	68.998	2.718	146.324	20.45	33.752	1.874	36.700	1.965	3.443	1.035	29.546	2.335
22	73	69.048	2.138	145.410	19.05	33.593	1.839	36.771	1.931	3.327	.910	29.855	2.003
Average		68.948		144.184		33.611		36.749		3.440		29.519	
TOTAL	1043												
						1928-1932							
18	231	69.072	2.266	142.749	19.12	33.625	1.925	37.013	2.103	3.361	.958	28.832	2.188
19	188	68.979	2.574	142.926	19.17	33.515	1.715	37.025	1.940	3.518	.973	28.947	2.293
20	89	69.219	2.287	146.910	19.41	33.941	2.103	37.435	2.400	3.632	1.003	29.747	2.400
21	106	68.972	2.364	145.094	18.51	34.250	1.784	37.458	1.995	3.462	.9025	29.566	2.182
22	96	68.727	2.335	145.520	18.68	34.139	1.944	37.583	2.149	3.498	.928	29.532	2.218
Average		68.993		144.639		33.894		37.302		3.494		29.124	
TOTAL	710												
						1933-1937							
18	300	69.5436	2.456	144.600	17.240	34.122	1.885	37.392	2.011	3.518	.873	29.118	2.040
19	300	69.2969	2.482	144.533	20.990	34.219	2.266	37.528	2.355	3.582	.855	29.297	2.370
20	300	69.3695	2.522	143.629	18.513	34.136	2.053	37.452	2.180	3.590	.814	29.303	2.257
21	303	69.1163	2.703	145.326	19.280	34.208	2.015	37.467	2.174	3.544	.859	29.678	2.184
22	244	69.2296	2.434	147.581	20.035	34.594	2.096	37.972	2.290	3.622	.891	29.726	2.471
Average		69.3109		145.133		34.255		37.562		3.571		29.424	
TOTAL	1447												

TABLE 7 (continued)

Age	N	Height Mean	Height SD	Weight Mean	Weight SD	Chest (Expiration) Mean	Chest (Expiration) SD	Chest (Inspiration) Mean	Chest (Inspiration) SD	Chest Expansion Mean	Chest Expansion SD	Waist Mean	Waist SD
						1938-1942							
18	302	69.4901	2.532	145.820	20.710	33.062	2.445	37.149	2.428	3.255	.818	29.262	2.520
19	289	69.610	2.233	145.761	19.240	34.211	2.111	37.167	2.191	3.279	.850	29.210	2.066
20	300	69.517	2.266	145.533	19.92	34.238	2.343	37.576	2.294	3.488	.866	29.265	2.650
21	290	69.756	2.618	146.932	20.81	34.253	2.231	37.372	2.287	3.411	.853	29.351	2.106
22	220	69.691	2.501	149.609	19.67	34.733	2.036	37.695	2.247	3.378	.916	29.682	2.491
Average		69.613		146.731		34.091		37.392		3.362		29.354	
TOTAL	1401												
						1943-1947							
18	301	69.742	2.333	150.321	24.01	34.370	2.265	37.246	2.251	3.134	.820	29.487	2.564
19	217	69.624	2.430	154.618	24.02	34.742	2.562	37.574	2.754	3.160	.876	29.814	2.870
20	232	69.642	2.625	154.619	21.93	34.928	2.228	38.308	2.338	3.227	.907	29.794	2.550
21	207	69.709	2.452	155.800	21.83	35.039	2.389	37.909	2.415	3.141	.879	30.149	2.444
22	187	69.498	2.461	151.738	20.83	34.878	2.265	38.408	1.968	3.163	.886	30.281	2.932
Average		69.643		153.401		34.791		37.889		3.165		29.905	
TOTAL	1144												
						1948-1952							
18	300	70.112	2.285	155.277	24.94	34.972	2.966	37.885	2.521	3.078	.859	29.911	2.966
19	301	69.933	2.592	155.332	22.47	35.118	2.384	37.954	2.296	3.006	.819	30.000	2.703
20	300	69.667	2.34	156.600	24.52	35.278	2.585	38.168	2.564	3.124	.838	30.407	2.926
21	299	70.207	2.782	155.566	20.18	35.180	2.180	28.099	2.01	3.147	.813	30.340	2.607
22	287	69.856	2.352	155.014	24.94	35.201	2.282	38.145	2.36	3.190	.911	30.313	2.508
Average		69.955		155.557		35.149		38.050		3.109		30.001	
TOTAL	1487												